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ABSTRACT

Reported were programs and procedures developed by the Eastern Regional Institute fcr Education (ERIE) to install a process oriented science program in regional elementary schools. Three installation phases were involved: 1) selection of the installation vehicle by ERIE and local schools, 2) installatien tryout, and 3) adoptien of the installed program. Science - A Process Approach was selected fcr installatien in pilot schools beginning with the 1967-68 school year. School selection criteria included diversity in sccic-ecconomic and public-parochial factors. Reciprocal working relatienships were established with 21 pilot schools and included inicrmatien services and inservice training for teachers and administrators; provision of teacher and student instructional materials; and regular consultative visitatien. Instruments for student competency and demographic data were administered. Pilot schools varied in instructicnal time and completed AAAS science activities. The adoption phase was considered incomplete. Installation process side effects included: extended use of Science - A Process Approach in nen-pilot schools, extended ERIE dissemination involvement; expanded teacher education and consultation services and cooperation with state departments of education; and further implementatien of ERIE's "Regional Action Network" and "Process Leader" programs. (JM)

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A REGIONAL APPROACH TO IMPROVING ELEMENTARY SCHOOL SCIENCE

INTRODUCTION

The Eastern Regional Institute for Education (ERIE) is one of a network of regional educational laboratories in the United States established under Title IV of the Elementary and Secondary Education Act of 1965. Fifteen educational laboratories are funded by the United States Office of Education. All work on a regional and, ultimately, on a national basis to improve the quality of elementary and secondary education. Specific programs vary; major activities include identifying, researching, developing, and initiating educational improvements. Each of the regional laboratories is striving, in its own way, to bridge the gap between educational theory and practice.

THE GENERAL PROGRAM OF ERIE

The Eastern Regional Institute for Education serves a geographical region encompassing northern and western Pennsylvania and all of New York State except for metropolitan New York City. The Institute has chosen as its specific commitment a program for improving "process-oriented" education in elementary schools. Recent ERIE documentation[1] of this program stated

> In 1963 Schools for the Sixties urged that priority be given to such objectives for children as learning how to learn, using rational processes to solve problems, developing basic skills, exploring values, and understanding concepts of general utility. As the decade ends, these priority objectives still demand greater representa-

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tion in elementary school practices across the country. Pupils need assistance in the development of those intellectual processes which are needed for their success in school and, more importantly, for the life-long learning which a rapidly changing society requires of all citizens. In process-oriented education these aims are given increased emphasis; fostering the mental development of each child is seen to require special teaching efforts even while the traditional goal of imparting knowledge is sought.

The Eastern Regional Institute for Education is effective in causing elementary schools to introduce process-oriented instruction, in establishing interagency cooperation to amplify this accomplishment, in devising a plan to analyze and synthesize process-promoting curricula, and in cultivating the cooperation of collaborative schools in which to test, modify, and articulate relevant curricula.

ERIE'S EXPERIENCE IN CURRICULUM INSTALLATION

In 1967 ERIE moved to make a beneficial impact on schools by installing an existing process curriculum, Science--A Process Approach.[2] Developed under the auspices of the American Association for the Advancement of Science (AAAS), Science--A Process Approach was judged to epitomize a process-promoting education, since the objectives of the program are concerned with such intellectual skills as observing, classifying, measuring, and inferring.

Despite the process potential of Science--A Process Approach, ERIE could not assume that widespread dissemination of any improved method of science education automatically guarantees widespread utilization. Guba[3] has commented

that the country is replete with examples of innovations that have floundered because supporting structures were not available. Guba also has maintained that schools must be helped to adopt, adapt, and integrate an innovation until it becomes a locally valued and locally maintained "noninnovation." The strategy for installation followed by ERIE was carefully articulated in a statement of objectives, in the selection of pilot schools, in the selection of a curriculum of vehicle, and in the reciprocal agreements worked out between ERIE and the participating pilot schools.

Objectives

The major objectives of the installation strategy were as follows:

1. To design a system for installing and monitoring process curricula in various school settings.

2. To install and monitor on an extended basis Science--A Process Approach in schools of diverse characteristics.

3. To test and subsequently improve this installation and monitoring system.

4. To describe this system to appropriate audiences so that this installation system can be replicated by others.

5. To collaborate with other agencies in the employment of the emerging design so as to effect curricular change in the schools within the ERIE region.

The Installation Setting: Selection of Pilot Schools

Twenty pilot schools were selected in 1967-68 to provide a varied setting for the operation of the installation strategy; one of the original group was later withdrawn through mutual agreement; two parochial schools were added in 1968-69, bringing the current number of pilot schools to twenty-one. The diversity of characteristics among the pilot schools is suggested by the list of community and school settings below.

1. Upper middle-class "bedroom" communities within commuting distance of a metropolitan area (one school).

2. Middle-class suburban communities near a large industrial city (four schools).

3. Rural-suburban communities within 25 miles of a metropolitan area possessing a population of at least 100,000 (two schools).

4. Small cities of less than 50,000 population (three schools).

5. A campus school located at a state-supported teacher training institution (one school).

6. Lower middle-class rural communities with a population engaged in small business and agricultural employment (three schools).

7. Depressed rural areas in remote unproductive areas (three schools).

8. An inner-city school serving disadvantaged students (one school).

9. A large city school serving a representative city population (one school).

10. Parochial city schools (two schools).

The data bank amassed during an intensive demographic study of these schools serves further to underline their diversity. Their per-pupil expenditures for instruction vary from $293 to $720. The percentage of fathers in professional occupations ranges all the way from zero to a high of 65 percent; the percentage of fathers in "unskilled" occupations is as high as 55 percent in one of the schools and as low as 4 percent in another.

Selection of the Vehicle: Science--A Process Approach

Members of the ERIE staff are frequently asked to justify the selection of Science--A Process Appraoch as the installation vehicle. The answer is clear when one examines the criteria ERIE employs in its search to identify curricular units that are process-promoting.

The Institute staff identified five elements that must be present in an effective process-promoting curriculum:

1. Clear statements of instructional objectives.

2. A variety of refined instructional materials, methods, and organizational arrangements.

3. Reliable and valid tests of pupil proficiency.

4. An effective teacher-education program.

5. Evaluative data on effective utilization of the curriculum in elementary schools.

Although no existing curriculum has been identified that fully satisfies the above criteria, Science--A Process Approach comes close to meeting them. There can be little doubt that, at the time of ERIE's initial installation efforts, Science--A Process Approach was (and probably remains) the most appropriate elementary school science curriculum for installation as a process-promoting educational vehicle.

Reciprocal Working Relationships: ERIE-Pilot Schools

Another dimension of the installation strategy is evident in the reciprocal working relationships between ERIE and the pilot schools. Basically, ERIE has supplied virtually identical services to each of the pilot schools during the 1967-68 and 1968-69 school years.

1. Informational services, including preliminary conferences with teachers and administrators.

2. Inservice training preparatory to teaching Science--A Process Approach for both teachers and administrators. To this end, full-week workshops were conducted by ERIE at Ithaca College during the summers of 1967 and 1968.

3. Provision of teacher manuals, kits of materials, and replacement supplies.

4. Regular consultant visits (biweekly or triweekly) by ERIE staff associates.

5. Mid-year conferences for administrators.

6. Petty cash fund to enable the immediate local purchase of incidental materials.

7. Where requested, the training of local "process leaders."

In return for the above services by ERIE, each pilot school has agreed to provide the following research data relative to the installation effort:

1. Results of Science--A Process Approach "competency measures" administered to pupils. (Upon completion of each exercise, each pilot teacher is asked to test individually three pupils randomly selected from her class.)

2. Demographic date. (This task was carried out for ERIE by the American Institutes for Research.)

3. Questionnaire and other types of research data on an annual basis as requested.

THREE PHASES IN THE INSTALLATION PROCESS

Since it is doubtful that the transition from "new program" to "installed program" can occur in one monumental step, it may be best to visualize the change as proceeding through a series of phases in the installation process. Brickell[4] has pointed out that the most successful innovations are those which are accompanied by the most elaborate help to the teachers who are implementing the innovation. ERIE has included most of these "teacher supports" as components of the installation phases.

Phase I: The Installation Decision

1. The local system identifies a curricular area in

need of strengthening and/or updating.

2. School administration and staff name the innovative program for installation and they mutually accept the installation task. This decision is made only after the full spectrum of available appropriate programs has been examined.

* 3. Preliminary inservice training begins.

Phase II: The Installation Tryout

* 1. Inservice training is provided for pilot teachers (i.e., K-2 or K-3 teachers).

* 2. Inservice training is provided for pilot school administrators.

* 3. All necessary instructional materials, such as texts, equipment, and supplies are provided.

* 4. Continuing expert consultant services are made available to pilot teachers and administrators.

5. Pilot teachers use the new program with their classes.

6. Pilot teachers provide such evaluation data as competency measure results, feedback forms, and questionnaire data.

* 7. Inservice training is provided for additional and/or replacement pilot teachers. (This may take several years to complete, especially in the case of a highly sequential K-6 program.)

* 8. Optionally, the school system may decide to train one or more staff members as "teacher leaders," who serve as

on-site change agents.

* 9. As expendable teaching supplies are used, replacement materials are provided.

* 10. Additional instructional materials for "new" teachers are provided.

* 11. School administration and teaching staff carefully examine evaluative data regarding the innovation, in order to decide either to reject or adopt the program on a district-wide basis.

12. School administrators and teaching staff collectively formulate local modifications for best articulation of the new program into the total local curriculum (i.e., articulation into weekly time schedule, with other subjects, with the secondary school program).

Note:

The items starred above (*) represent materials and/or services provided to pilot schools by ERIE, or items which ERIE and the pilot school jointly invested in the installation effort.

Phase III: Adoption of the Installed Program

At what point should a curricular installation be considered "complete?" The answers one receives in response to this question are as diverse as the ERIE pilot schools. In the past the delivery of a new set of textbooks marked both the beginning and the termination of a curricular "change." At least one could believe this to be the case, since all too fre-

quently, nothing was planned or done beyond this step. Some insist that the installation effort is endless--that it must persist until another curricular "breakthrough" occurs.

As Wilhelms[5] has remarked,

> Not all of the school innovations of yesterday have lived up to their promise for today. Many educators agree that the basic problem in innovation today is the lack of systematic planning and trained leadership. Schools are given money to buy equipment, budget little or no money to train teachers. The effect of this haphazard approach is that promising research results are not reaching the classroom.

In the dual role of "instigator and investigator" of curriculum installation, however, ERIE could not accept these extreme views. It was necessary to construct an operational definition of a successfully installed program: Phase III of the Installation Process. In the opinion of the ERIE staff, the following six characteristics mark a true installation:

1. If the curriculum is a sequential program, it is accepted and used by <u>all</u> of the appropriate teachers. In other words, the program actually is taught systematically to all pupils within acceptable parameters for instructional quality and quantity.

2. The school system builds the costs of the program into its ongoing budget. (Continuation of the program is not dependent upon temporary outside funding.)

3. The administration and teaching staff have addressed themselves to problems of articulating the innovation so that it fits well into the total instructional program of the school.

4. The teaching staff has had an adequate opportunity to use the new program. They have collectively decided what modifications (if any) are appropriate and necessary to meet local needs. These modifications do not violate the basic nature and design of the innovation.

5. The school system has formulated plans for continuing needed inservice training, both for present staff and for "new" faculty members.

6. The services of an "outside" installation organization are no longer directly needed.

PRELIMINARY RESULTS OF ERIE'S INSTALLATION STRATEGY

What happens when twenty-one schools of diverse characteristics are provided with identical resources by an outside installation agency? Predictably, each pilot school tends to respond in its own particular way, moving at its own pace. All pilot schools are responding to ERIE's intervention in Phase II of the installation process described above.

Time Per Week for Science Instruction

The data now on file for the 1967-68 school year substantiate the variable affects among the schools after ERIE's intervention with Science--A Process Approach. For example, in all cases the time per week spent on science instruction increased. The increase in the mean science instruction time varied from 5 minutes to 87 minutes per week. It is interesting to note that the mean science instruction time for the schools as a group jumped from 66 minutes per week before the installation to 117 minutes per week during 1967-68.

Thus, the mean increase in science instruction time for the schools was 51 minutes per week, an effect which reflects favorable the impact of ERIE's installation of Science--A Process Approach.

Completed Exercises

The data from the pilot schools also indicate variable effects in terms of the number of completed science exercises. Science--A Process Approach is divided into seven parts, one for each grade (K-6); each part in turn is composed of a series of exercises. The total number of exercises per part varies from 22 to 26, an average of 24 per part. Work on a single exercise in Science--A Process Approach usually requires several school days. The total number of exercises a teacher completes per year provides one indication of her willingness and/or ability to teach this innovative curriculum.

Table I provides data regarding the completion of Science--A Process Approach exercises by ERIE pilot schools during 1967-68.

TABLE I

COMPLETION OF SCIENCE--A PROCESS APPROACH EXERCISES
ERIE PILOT SCHOOLS BY GRADE: 1967-68

Grade	Number of Exercises In Part	Range of Means	Means for All Schools	Standard Deviations
K	22	9-22	14.68	3.32
1	26	3-23	15.68	4.92
2	23	2-21	12.37	4.81
3	22	2-20	11.00	3.30

Those familiar with Science--A Process Approach will be interested in the competency measure results which have been obtained in the ERIE pilot schools. AAAS has reported that, during its tryout of Parts One to Four (experimental versions of what now are known as Parts A to D), 90% of the children tested acquired at least 80% of the specified behaviors in more than four-fifths of the exercises.

The ERIE data presented in Table II, although tabulated somewhat differently from the mode chosen by AAAS, appear to corroborate this finding. Note that no exercises in Parts A to C fall into Acquisition Category IV, whereas the greater bulk of exercises are found in Categories I and II.

TABLE II

PERCENTAGES OF EXERCISES IN VARIOUS ACQUISITION CATEGORIES* BY PART (ERIE, 1967-68)

Acquisition Category*	Part A	Part B	Part C	Part D
I (90 - 100%)	23.8	38.5	26.1	12.5
II (80 - 89%)	66.7	50.0	56.5	41.7
III (70 - 79%)	9.5	11.5	17.4	41.7
IV (Below 70%)	0	0	0	4.1

* "Acquisition Category" provides a way of classifying the exercises of Science--A Process Approach according to how well

pupils actually acquire the behaviors specified for each exercise. For example, "Acquisition Category I" includes those exercises in which 90 to 100 percent of the pupils tested by ERIE pilot teachers did indeed exhibit the specified behaviors of these exercises.

Current Status of the Installation of Science--A Process Approach

The ERIE pilot schools have yet to reach Phase III of the installation process: adoption of installed curriculum. There is evidence available to substantiate this statement.

1. Not all teachers, K-6, of the pilot schools are teaching Science--A Process Approach at this time. This is due to one of several reasons: (a) the fifth- and sixth-grade portions of the program are still in production, (b) ERIE pilot teachers are volunteer teachers, and some have chosen not to participate, and (c) some trained pilot teachers have left pilot schools and trained replacements are as yet not available in every case.

2. Those teachers listed as pilot teachers are not teaching the entire course in any given year. The data of Table I make this clear.

3. Pilot school administrators and teachers have not as yet resolved the problems of articulating Science--A Process Approach into the total curriculum nor within the science curriculum from one grade to the next.

While it is true that the installation can as yet not be considered complete, numerous accomplishments indicate that the pilot schools are indeed moving toward this goal. For example, during the 1968-69 school year, the number of pilot school teachers teaching Science--A Process Approach increased to the point where, presently,

relatively few gaps exist in Grades K-4. In addition, it appears certain that the year-end tally of exercises completed will show a substantial increase over the previous year.

The 1969-70 school year will represent another stage of transition in that ERIE will gradually begin to withdraw its financial commitment to the pilot schools. Beginning in September, 1969, each pilot school will become responsible for providing replacement expendable materials, inservice training for replacement of additional teachers, and any required kits or teacher manuals for Grades K-3. ERIE will continue to provide consultant service to the schools, and will provide replacement materials and inservice training for pilot teachers at Grades 4 and 5. This gradual withdrawal of "outside" support is designed to provide a planned transition from full ERIE support to the full local support called for in Phase III. At present, then, it is best to think of the installation of Science--A Process Approach in the ERIE pilot schools as being "in process," with installation proceeding more rapidly in some of the schools than in others.

Side Effects of ERIE's Installation Efforts

In the meantime, ERIE's intervention is producing a number of side effects which appear to be of considerable significance. For example, it is of interest that some pilot schools have, at their own expense, decided to extend the use of the innovation to other buildings within their district. Of the sixteen pilot school districts in which such expansion is

a possibility, thirteen have chosen to do so (3 of the original 19 pilot schools are "one-building" elementary schools, at least K-3).

Another kind of expansion has resulted from ERIE's involvement in elementary science. As ERIE's intervention among the pilot schools became more widely publicized, a large number of requests for information began to flood the ERIE office. Since it was not practical to attempt to meet each request individually, it was decided to arrange in cooperation with Title III Centers a number of "Dissemination Meetings." Each of these 10 meetings dealt specifically with Science--A Process Approach, the program itself, as well as anticipated problems in installing it. These meetings appear to have fulfilled some purpose; they were well-received and well-attended. However, they failed to quell the influx of requests for assistance reaching the ERIE staff. If anything, they induced an increase of interest in Science--A Process Approach within the two-state ERIE region.

Beyond requests for information, most inquiries expressed needs for teacher training and/or consultant services. With this in mind, ERIE embarked on a two-phase program designed to meet the expressed needs. It was proposed to the National Science Foundation that it fund the establishment of a "Regional Action Network" for the dissemination of assistance to schools installing Science--A Process Approach and other innovative elementary science programs. Simultaneously, it was proposed to the New York State and Pennsylvania State Departments of

Education that they help to underwrite the expense of training a large number of K-3 teachers to teach Science--A Process Approach. The funding of these two programs marked an extension of ERIE's direct intervention within its region.

The Regional Action Network

The ultimate goal of ERIE's "Regional Action Network" (RAN) is to encourage and nurture the effective examination and installation of process curricula in the elementary schools of New York and Pennsylvania. The immediate purpose of this ERIE/College/School collaboration is to improve elementary science education.

The RAN program is built around the training and involvement of college teaching staff in the installation process. During August, 1968, ERIE shared its process science curriculum experience with a group of twenty college and university science professors. Building upon Science--A Process Approach and other innovative science curricula, the program also included attention to process-promoting instructional techniques, the philosophical and psychological foundations of process science, and counseling behaviors effective in assisting teachers to implement innovations in their science instruction. Additional conferences, on-site visits to ERIE pilot schools, and participation in a series of science "Demonstration Days" constitute other important components of the RAN program. Some of the professors almost immediately began to establish consultant relationships on a regular basis with nearby schools. It is planned to use the full complement of RAN professors as con-

sultants to ERIE pilot and demonstration schools during the 1969-70 school year. An additional group of 25 professors are scheduled to participate in a similar training program this summer. The combined total of 45 RAN professors constitutes an effective consulting team for extended installation efforts in the schools of the ERIE region.

An example of the kind of active regional involvement which RAN will stimulate is provided by "Demonstration Days," some 14 of which were conducted during 1968-69. Brickell[4] indicates that "the most persuasive experience a school person can have (relative to deciding to attempt a curricular change) is to visit a successful new program and observe it in action." He recommends that such visits occur in schools "quite similar to those from which visitors come." Each of the "Demonstration Day" events employed one or more RAN professors as visiting consultants, although it was otherwise entirely a local project conducted cooperatively by a Title III agency and pilot school teachers and principals. It was estimated that this program enabled more than 700 teachers and administrators to observe Science--A Process Approach in operation in "real school" settings much like their own.

Collaboration with State Education Departments: Inservice Education

The ERIE summer teacher and administrator Science--A Process Approach workshops, originally intended for pilot schools only, grew to almost monumental proportions with the addition

of non-pilot school personnel. During the last week of August, 1968, more than 350 teachers and some 70 administrators received Science--A Process Approach training under ERIE leadership. Of this total some 45 teachers and five administrators were sponsored by the Pennsylvania Department of Public Instruction on a matching-funds basis. Concurrently, the New York State Department of Education sponsored, also on a matching-funds basis, the training of 183 teachers and 29 administrators. The remaining teachers and administrators were affiliated with the ERIE pilot schools.

The foregoing demonstrates the success of ERIE's activities as an "interagency agency." From a relatively small beginning involving 20 pilot schools, ERIE's regional impact has spread to:

1. Twenty college professors (soon to be 45 in number) prepared and ready to serve as process consultants within the ERIE region.

2. Teachers and administrators from 20 Pennsylvania and 54 New York State non-pilot schools.

3. A multitude of other non-pilot school teachers and administrators who participated in one or more of the ERIE-sponsored informational meetings.

Process-Leader Program

There remains one ERIE-initiated program to be described: the "Process Leader" program. During the initial year of the curriculum installation, it became apparent to ERIE staff that a need existed for the careful nurture of Science--A Process Approach within their schools. During August, 1968, ERIE undertook the training of 12 pilot school elementary teachers (nominated by their fellow teachers and administrators) to serve as process

leaders. A basic assumption was made that process leaders can exert a "horizontal" influence upon the perceptions and behaviors of teaching colleagues while avoiding the suspect position of being an arm of the administration. It was hypothesized that a cadre of process leaders, knowledgeable in the philosophy, psychology, and methodology of change in a given area, can escape the traditional constraints which operate against change in schools and can effectively influence their colleagues.

The process leaders serve as an important intermediary between the school, other educational organizational organizations, and the Institute, bringing a closer understanding of the needs of the local school and in return providing information on the rationale of the innovation and the strategies of change needed by local school faculty. Having escaped the relative isolation of the classroom and yet free from the negative connotations of "supervision," these peer agents of change may hold an important key to teacher commitment toward the successful installation of an innovative curriculum.

THE OUTLOOK

It is as yet too early to assess the total impact of ERIE's efforts with Science--A Process Approach in the schools of the ERIE region. However, it appears safe to say that there has been an impact. It is hoped that the impact will prove to have lasting effects for improving science education and that other agencies in other regions will strive to produce similar effects.

ERIE's Process Curriculum Program is developing alternative strategies for installation, using different vehicles in different settings. All are intended to improve elementary education through the widespread adoption of process-oriented curricula.

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